**Minds On: Qualitative vs Quantitative**

Course: SCH3U

Unit: Quantities in Chemical Reactions

Lesson: Introduction to the Unit

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| **BIG IDEAS**: | **MATERIALS**: |
| - Relationships in chemical reactions can be described quantitatively.  - The efficiency of chemical reactions can be determined and optimized by applying an  understanding of quantitative relationships in such reactions |  |
| **MINISTRY EXPECTATIONS**: |
| A1.1, A1.2, A1.8 formulate relevant scientific questions about observed relationships, or problems; select appropriate instruments and identify appropriate methods, techniques for each inquiry; synthesize, analyse, interpret, and evaluate qualitative and quantitative data;  D1.2 assess the importance of quantitative accuracy in industrial chemical  processes |
| **STUDENT LEARNING GOALS**: | **APPENDICES** |
| 1. Students learn to develop understanding of what qualitative and quantitative data are 2. Understand where and when to use the different types of data collection | Appendix A: Qualitative or quantitative mix and match  Appendix B: Scenarios: What type of data works best? Student Handout  Appendix C: Scenario: What type of data works best? Teacher Handout |
| **PRIOR KNOWLEDGE:** |
| * Basic ideas of what qualitative and quantitative data are |

**Overview & Teaching Notes**

This activity is to start off the unit Quantities in Chemical Reactions (SCH3U). This majority of this unit are calculations and using quantitative data to solve problems and explore concepts. This minds on is to emphasise the uses of quantitative data as well as showing where qualitative still fits in science.

**Implementation (Approximately 40 min with 3 parts):**

1. **Defining qualitative and quantitative (5 min)**

Explain to the class that this unit deals with quantitative data and not qualitative. Ask them to turn to their partner (think-pair-share) and define the two terms. Bring it back to the class have them define it.

Here is a list of points they should have/know:

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| **Qualitative Data** | **Quantitative Data** |
| * Deals with descriptions * Data can be observed but not measured * Colors, textures, smells, tastes, appearance, beauty, etc. * **Qualit**ative → **Qualit**y | * Deals with numbers * Data which can be measured * Length, height, area, volume, weight, speed, time, temperature, humidity, sound levels, cost, members, ages, etc. * **Quantit**ative → **Quantit**y |

1. **Qualitative vs quantitative recognition activity (Appendix A) (5-10 min)**

Give each table or group of 4 (should have *at least* 4 people) the three examples cut-outs (should have six boxes in total) and have them group them into qualitative and quantitative. Take it up as a class and have them explain why they grouped them in that way.

Answers: All on the left are qualitative and all on the right are quantitative; so be sure to cut them out and mix them up.

1. **Two approaches to a problem activity (Appendix B and C) (30 min)**

Each group will split into two sections and each will be given their own scenario. Give the groups one copy of each handouts in Appendix B. Have them work in pairs (or threes) to complete their scenario.

After each pair is done their part, have them come back together as a group and discuss each scenario and the pros and cons of each method (ie qualitative vs quantitative). Write it out on a piece of chart paper which method of data collection they chose for each scenario and the pros and cons of each method (may use diagrams/pictures to describe the pluses and minuses of each method).

After go over as a class:

Why quantitative data is important:

* + To be able to do calculations from it to solve for what you need (ex. How many grams of substance A do I need to react with substance B)
  + To get hard numerical facts on topics/experiments to provide evidence for principles and laws
  + It gives you that firm grasp on what and how things are changing

Why qualitative data is important:

* + - Need observations on how and what changes during experiments to obtain quantitative (ex. Indicator colour change showing neutralization)
  + - Field observations to initially develop questions/plausible variables for an experiment or theory (ex. I notice that when this is added the solution goes opaque therefore something must be happening. From there you can develop a hypothesis.)
  + - Not as concrete and firm but gives many important details that you may not need to be quantitative to be useful (ex. Colour of solution, bubbles being produced, smell)

**Appendix A – Qualitative or Quantitative Mix and Match**

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| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | |  |  | | --- | --- | | **Example 1:**  ***Oil Painting*** | http://www.oilpaintings2008.com/images/Landscape19.jpg |  * blue/green color of trees and rivers * smells new and fresh * detailed in the strokes * calming scene of a river | |  |  | | --- | --- | | **Example 1:**  ***Oil Painting*** | http://www.oilpaintings2008.com/images/Landscape19.jpg |  * picture is 12" by 18" * weighs 9 pounds * surface area is 216 sq. in. * cost $400 | | |  |  | | --- | --- | | **Example 2:**  ***Latte*** | http://www.miffmuff.com/wp-content/uploads/2011/07/amazing-coffee-latte-art-15.jpg |  * pleasant aroma * monkey appearance * potent taste * white cup and saucer | |  |  | | --- | --- | | **Example 2:**  ***Latte*** | http://www.miffmuff.com/wp-content/uploads/2011/07/amazing-coffee-latte-art-15.jpg |  * 12 ounces * serving temperature 80ºC. * serving cup 7 cm in height * cost $4.95 | | |  |  | | --- | --- | | **Example 3:**  ***Grade 11 Chemistry Class*** | http://www.cartoonresource.com/umbraco/ImageGen.ashx?image=/436801/etg211ry.jpg&class=full |  * friendly demeanors * creatively minded * visionaries * positive spirit | |  |  | | --- | --- | | **Example 3:**  ***Grade 11 Chemistry Class*** | http://www.cartoonresource.com/umbraco/ImageGen.ashx?image=/436801/etg211ry.jpg&class=full |  * 26 students * 14 girls, 12 boys * 68% on honor roll * 15 students also in biology | |

**Appendix B – Student Handout**

**Scenarios: What type of data works best?**

For your scenario, decide whether it’s better to gather qualitative data, quantitative data, or a mix of both to answer the question.   
  
**Scenario 1:** You work in an office that has a coffee maker. Each pot holds 8 cups of coffee. Your boss asks you to figure out how many refills your office will need every month, because she’s trying to do the budget.   
  
a) Why type of data collection would you use? (qualitative and/or quantitative) Why? 

b) Describe how you would collect the data (what tools would you used and/or who you would talk to).

For your scenario, decide whether it’s better to gather qualitative data, quantitative data, or a mix of both to answer the question.

  
**Scenario 2:** You’re a hockey player who has recently joined a new team. It’s halfway through the season, and so far, your coaches and teammates appear content with your performance. But you’re still on the second line so you want more information on how to improve so that you can move up to the top line.

a) Why type of data collection would you use? (qualitative and/or quantitative) Why? 

b) Describe how you would collect the data (what tools would you used and/or who you would talk to).

**Appendix C – Teacher Handout**

**Scenarios: What type of data works best?**

For your scenario, decide whether it’s better to gather qualitative data, quantitative data, or a mix of both to answer the question.   
  
**Scenario 1:** You work in an office that has a coffee maker. Each pot holds 8 cups of coffee. Your boss asks you to figure out how many refills your office will need every month, because she’s trying to do the budget.   
  
a) Why type of data collection would you use? (qualitative and/or quantitative) Why?   
- Quantitative mostly, but qualitative may help

- Need to find out the number of coffee packages you need to buy so you can find out how much it will cost for the month so we’ll need an exact number, thus quantitative

- Qualitative can also be used to help support the quantitative (see point 3 below)  
  
b) Describe how you would collect the data (what tools would you used and/or who you would talk to).

- Would collect it by measuring how much coffee is used every day (fresh grounds). Count the number of packages to start the day and how many to end the day and find the difference. Do this for the week to calculate an average on a weekly basis to reduce error from one day.

- Could also ask everyone (survey or chart for the week) how many cups they drink on a daily basis and work back to how many pots will be made. Need to account for wasted coffee as well so use qualitative data on when they drink it to see when it will likely be thrown out if not used.

For your scenario, decide whether it’s better to gather qualitative data, quantitative data, or a mix of both to answer the question.

  
**Scenario 2:** You’re a hockey player who has recently joined a new team. It’s halfway through the season, and so far, your coaches and teammates appear content with your performance. But you’re still on the second line so you want more information on how to improve so that you can move up to the top line.

a) Why type of data collection would you use? (qualitative and/or quantitative) Why?   
- Qualitative mostly, but quantitative can help keep progress

- Because your place on each line is based on your coaches perception of how you’re playing, thus you can have the best stats but still not be on the top line, thus you need to find out what aspects of your game are missing to improve.

b) Describe how you would collect the data (what tools would you used and/or who you would talk to).   
- Ask coaches and teammates for feedback on what you do well and where you can improve

- May be able to get your parent to gather quantitative data (ex. faceoff’s won, goals scored, battles won in corner) in order to mark your progress in the areas where your coaches want you to improve.